Tunneling Nanotubes and Gap Junctions-Their Role in Long-Range Intercellular Communication during Development, Health, and Disease Conditions.

Journal: Front Mol Neurosci

Publication Year: 2017

Authors: Jennifer Ariazi, Andrew Benowitz, Vern De Biasi, Monique L Den Boer, Stephanie Cherqui, Haifeng Cui, Nathalie Douillet, Eliseo A Eugenin, David Favre, Spencer Goodman, Karine Gousset, Dorit Hanein, David I Israel, Shunsuke Kimura, Robert B Kirkpatrick, Nastaran Kuhn, Claire Jeong, Emil Lou, Robbie Mailliard, Stephen Maio, George Okafo, Matthias Osswald, Jennifer Pasquier, Roel Polak, Gabriele Pradel, Bob de Rooij, Peter Schaeffer, Vytenis A Skeberdis, Ian F Smith, Ahmad Tanveer, Niels Volkmann, Zhenhua Wu, Chiara Zurzolo

PubMed link: 29089870

Funding Grants: Ex vivo transduced autologous human CD34+ hematopoietic stem cells for treatment of cystinosis

Public Summary:
Tunneling nanotubes (TNTs) are long cytoplasmic bridges that have emerged as a new type of intercellular communication allowing the transport of various signals, organelles and pathogens. However, the exact role of TNTs and gap junctions for intercellular communication and their impact on disease is still uncertain and thus, the subject of much debate. This is review reporting data from several research groups indicate that some TNT mediate a long-range cellular communication to coordinate metabolism and signaling, in relation to infectious, genetic, metabolic, cancer, and age-related diseases. This review aims to describe the current knowledge, challenges and future perspectives to characterize and explore this new intercellular communication system and to design TNT-based therapeutic strategies.

Scientific Abstract:
Cell-to-cell communication is essential for the organization, coordination, and development of cellular networks and multi-cellular systems. Intercellular communication is mediated by soluble factors (including growth factors, neurotransmitters, and cytokines/chemokines), gap junctions, exosomes and recently described tunneling nanotubes (TNTs). It is unknown whether a combination of these communication mechanisms such as TNTs and gap junctions may be important, but further research is required. TNTs are long cytoplasmic bridges that enable long-range, directed communication between connected cells. The proposed functions of TNTs are diverse and not well understood but have been shown to include the cell-to-cell transfer of vesicles, organelles, electrical stimuli and small molecules. However, the exact role of TNTs and gap junctions for intercellular communication and their impact on disease is still uncertain and thus, the subject of much debate. The combined data from numerous laboratories indicate that some TNT mediate a long-range gap junctional communication to coordinate metabolism and signaling, in relation to infectious, genetic, metabolic, cancer, and age-related diseases. This review aims to describe the current knowledge, challenges and future perspectives to characterize and explore this new intercellular communication system and to design TNT-based therapeutic strategies.